MDAs

and L will be completed in 2002. Design and construction activities in conjunction with remediating these MDAs will start shortly after public input is completed and a permit is modified.

Clean Closure Project. The objective of the MDA P Clean Closure Project is to remove and dispose of the Laboratory's 50,000-cubic-yard hazardous-waste landfill, under the provisions of Resource Conservation and Recovery Act. This seven-acre site is located at the TA-16 Burning Grounds in the southwestern area of the Laboratory. Between 1950 and 1984, high-explosive contaminated materials were burned at this site, and the rubble and debris were then pushed into the landfill. This closure project will be conducted in four phases: (1) excavation, segregation, treatment and disposal of all contaminated material from the landfill; (2) confirmatory sampling and analysis; (3) acceptance by New Mexico Environment Department of an independent report confirming clean closure; (4) stabilization and revegetation of the site.

The original MDA P Clean Closure plan was approved by the New Mexico Environment Department in February 1997. In the fall of 1997, the excavation contractor encountered detonable high explosives in test pits in the east lobe of the landfill, and all work was stopped. We revised the closure implementation plan so that excavation would be conducted remotely, and the high explosives would be removed by trained explosives ordnance technicians. The contractor began excavation again in February 1999, and it was completed in December 2000. Just over 51,500 cubic yards of soil and debris were excavated. We expect that disposal of the waste will be completed by June 2001. Confirmatory sampling will begin in May, and we will submit a final report confirming closure to the New Mexico Environment Department when the sampling is completed. As soon as the report is approved, the site will be recontoured and revegetated.

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Modeling

3-D Geologic Model of the LANL Site and the Española Basin

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The ER Project and Groundwater Protection Program are responsible for gauging the potential for migration of contaminants from various sites around the Laboratory. To enhance their understanding of this process, we are generating a geologic model of the area at two scales: Laboratory (138 square miles) and Española basin (2,500 square miles). At the Laboratory scale, the model will serve as a framework for detailed studies of the fate of contaminants such as in the Los Alamos Canyon region. At the Española Basin scale, the model will help interpret transport pathways through the regional groundwater table.

Our models, assembled from geologic maps, borehole data, high-resolution total station mapping, and interpretative cross-sections, are managed using Oracle. We use geographic information software (Arc/Info) to assemble the various data sources and to generate gridded surfaces representing geologic unit boundaries; using petroleum industry software (Stratamodel), we assemble these surfaces into 3-D geologic models. At present, the 3-D geologic models are built into 30 geologic units, from approximately 50,000 data records. The geology ranges from Precambrian basement to recent ash-flow tuffs to localized basalt flows. These models embed all of the spatial relations of the actual geology and can be used to generate geologic maps, cross sections, and similar materials, and they will be the framework for numerical models of hydrologic and contaminant transport processes.

Flow-and-Transport Modeling of the Material Disposal Areas (MDAs)

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LANL has 26 MDAs, mesa-top sites in the unsaturated zone in which waste was historically placed in subsurface pits or shafts. This material includes solid and liquid radioactive waste, heavy metals, and organic waste. The hydrologic settings of the MDAs vary from semiarid to periodically ponded. The ER Project is proposing a systematic method for assessing the risk associated with the MDAs that relies heavily on numerical flow and transport modeling. We are using subsurface flow and transport models to predict the long-term risk posed by MDAs to ecological receptors (including humans), so that informed decisions can be made regarding site remediation and closure. We are modeling contaminant migration from a few complex sites, each of which exhibits different hydrologic conditions and waste forms. We plan to abstract less complex groundwater models from these detailed studies and apply them to other MDAs at the laboratory, where appropriate. By comparing the conditions and waste forms at other MDAs to those at these well-studied MDAs, we hope to streamline the risk assessments and facilitate closure of the remaining MDAs. Preliminary studies of three complex sites, MDAs G, AB and L, are complete. A study of MDA H, one of the less complex MDAs, is currently underway. We plan to study and permanently close the site, and we anticipate that the process will form the basis for an MDA closure strategy.

A Groundwater Flow-and-Transport Model for Los Alamos Canyon

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The current conceptual model of groundwater flow and contaminant transport in the vadose zone beneath the Laboratory recognizes two main hydrogeologic settings: mesas and canyons. Flow and transport from mesa tops to the regional aquifer is thought to be slow because of low recharge rates and high rates of evaporation, caused by significant air circulation through the mesas. By contrast, canyons are characterized by focused, high recharge rates and potentially rapid transport through the vadose zone. Historic discharges of contaminated water into canyons on Laboratory property are therefore being studied to assess the possibility of deep transport of radioactive, inorganic, and organic contaminants that could conceivably pose a future risk of groundwater contamination in water supply wells.

Our work is progressing along four main fronts: (1) Geology and numerical grids: 2- and 3-D numerical grids were constructed based on the most recent version of the site geologic model. (2) Synthesis of hydrologic information: to provide appropriate rock properties and boundary conditions, relevant data were compiled from existing databases and reports. Important information used includes permeability and porosity of hydrogeologic units beneath the canyon and groundwater recharge estimates. (3) Flow model calibration and sensitivity analyses: to calibrate model, measurements of water content in characterization wells, and observations of perched water. For many of these data, adequate matches to the observations are obtained using base-case hydrologic properties and recharge estimates. The 3-D effects of varying recharge (canyon versus mesa) captured in the 3-D model allow water content profiles in wells LADP-3 (canyon) and LADP-4 (mesa) to be matched. Refinements are being made to the model to account for detailed processes such as local perching of water.
(4) Tritium transport results: the base-case model is in qualitative agreement with observations of tritium concentrations in perched water in several wells, and it suggests that most of the tritium introduced since the 1960s has either remained in the vadose zone or has decayed. However, a relatively small amount reaches the regional aquifer beneath canyon-bottom regions of relatively high recharge.